

CLAIMS

What is claimed is:

1. An intra-oral laser digitizer comprising:
 - a light source having collimating optics configured to generate a collimated beam of light;
 - a scanner optically coupled to the light source and configured to scan the collimated beam along at least two axes;
 - an optics relay coupled to the scanner and configured to relay the scanned, collimated beam towards a remote object to be imaged;
 - an image optics system having an optical axis configured to detect a reflection of the scanned beam from the object at an angle θ with respect to the optics relay and to generate data representative of a surface of the object based on the reflected beam; and
 - a processor coupled to the scanner and the image optics system configured to generate a three-dimensional image of the object based on the data.
2. The intra-oral laser digitizer of claim 1 where the light source comprises a laser LED.
3. The intra-oral laser digitizer of claim 1 where the scanner comprises a plurality of mirrors.
4. The intra-oral laser digitizer of claim 3 where the image optics system comprises:
 - an image sensor configured to detect a triangulation image of the object, the triangulation image based on a plurality of curves generated by scanning the beam of light on the object during an exposure period; and
 - an imaging lens system configured to focus the plurality of curves on the image sensor.

5. The intra-oral laser digitizer of claim 4 where the processor is configured to merge multiple images of the object to generate a three-dimensional map of the object.
6. The intra-oral laser digitizer of claim 5 where the object comprises any one of an in vivo dental item, a dental preparation, a dental model, a dental mold, or a dental casting.
7. The intra-oral laser digitizer of claim 1 where the scanner comprises a single mirror configured to scan the light along at least two-axes.
8. The intra-oral laser digitizer of claim 1 where the scanner comprises a rotatable mirror and a spinning polygon mirror.
9. The intra-oral laser digitizer of claim 1 where the scanner further comprises a programmable position controller configured to control the scan of the collimated laser beam in a programmed scan sequence.
10. The intra-oral laser digitizer of claim 1 where the known pattern comprises a plurality of curves each is substantially parallel to each other.
11. The intra-oral laser digitizer of claim 1 where the laser light source comprises a low coherence light source, the reflected light from the object being compared with light from the low coherence source reflected from a known variable path length.
12. The intra-oral laser digitizer of claim 1 further comprising a voice-recognition means for controlling operation of the intra-oral laser digitizer in response to voice commands of an operator.

13. A dental imaging system, comprising:
means for generating a collimated laser beam of light;
scanner means for generating a multi-axis collimated light beam;
beam relaying means for relaying the collimated light beam
towards an object to be imaged, the object to be imaged being remotely located
from the means for generating a collimated laser beam of light;
image capturing means for detecting reflections of the a focused
beam projected on an object; and
processor means coupled to the scanner means and the image
capturing means for generating a three-dimensional image of the object.
14. The laser digitizer of claim 13 where the scanning means scans the
beam across the object in a selected pattern via beam relaying means.
15. The laser digitizer of claim 13 where the image capturing means
comprises:
an image sensor configured to detect a triangulation image of the
object, where the triangulation image is based on a pattern of scanned lasers dots
across the surface of the object during an exposure period; and
an imaging capturing relay means to capture a reflection of the
pattern from the object and relay the captured reflection to the image sensor.
16. The laser digitizer of claim 15 where the beam relaying means
comprises an optical relay rod lens.

17. A method for generating a three-dimensional visual image of an in vivo object comprising:

generating a multi-axis collimated beam of light, the collimated beam of light being generated remotely from the object;

scanning the multi-axis collimated beam of light, from a first position with respect to the object, in a second pattern, where the pattern includes a plurality of substantially parallel curves having curvilinear segments;

capturing an image of a reflection of the pattern from the object during an exposure period; and

determining a map of the surface of the object based on the captured image.

18. The method of claim 17 where the act of scanning further comprises relaying the multi-axis collimated beam of light to an object in oral cavity.

19. The method of claim 17 further comprising the acts of:

scanning the multi-axis collimated beam of light, from a second position with respect to the object, in a predetermined pattern, where the pattern includes a plurality of substantially parallel curves having a curvilinear segments;

capturing an image of a reflection of the pattern from the object in the second position; and

merging the captured image from the first position with the captured image from the second position.

20. The method of claim 17 where the second pattern is substantially similar to the first pattern.